Phenology

Background

Phenology—the timing of seasonal, biological events—affects many aspects of the ecosystems on which plants and animals depend. Humans have always lived by nature's calendar, observing and responding to seasonal changes in their environment, such as the first flowering of a plant in spring, the end of leaf fall from a tree, the first appearance of a particular bird or animal, or the start of fish migration up-river to spawn. These events signaled when to plant crops, forage, hunt, move camp, host festivals, and perform rituals. Today, scientists call the biological events that mark seasonal transitions *phenological events*. Scientists study the timing of these culturally and ecologically important events to understand ecosystem functions like pollination and migration, take advantage of recreation opportunities like leaf peeping, predict allergy season, manage populations of rare or invasive species, and adapt to climate change. In 2009, the Northeast Temperate Network Inventory & Monitoring Program (NETN; tasked with monitoring the ecological health of parks in the northeast) and the Schoodic Education and Research Center teamed up with the USA National Phenological Network (USA-NPN) and The Wildlife Society to develop and test a citizen-science based phenology monitoring program for NETN parks. The goals for this pilot project are to evaluate techniques and methods to be used in a long-term phenological monitoring program and the ability of a volunteers to provide quality observations on phenological events in NETN parks. Acadia National Park, the Appalachian National Scenic Trail, Boston Harbor Islands National Park Area, Marsh-Billings-Rockefeller National Historical Park, and Saugus Iron Works National Historic Site are part of the pilot program. Efforts at pilot parks will serve as a model for other NETN parks on how to incorporate phenology monitoring into their activities to meet monitoring, research, management, and education needs.

Highlights and Accomplishments

In early 2009, NETN and USA-NPN scientists refined existing phenology monitoring protocols for use in northeastern national parks, and identified a suite of habitats and target species. In July and August, Acadia NP began recruiting and training volunteers, including teachers, students, Friends groups, park visitors, and local amateur naturalists, to monitor phenological events, such as flowering, leaf coloring, frog calling, and bird coloration. At Acadia NP one group of volunteers will monitor sites on Mount Desert Island, and another will monitor the Schoodic section of the park.

On the Schoodic Peninsula, wetlands along Alder Trail, wetland pull-offs along park roada, and coastal pull-offs park roads have been selected for monitoring. Volunteers on Mount Desert Island can choose from several sites: Sieur de Monts Spring, Jordan Pond, Duck Brook Road, Ship Harbor, Seawall, Jordan Steam Trail, Little Harbor Brook Trail, an coastal pull-offs along the loop road (e.g., Thunder Hole, Otter Point, or Little Hunters Beach).

By engaging volunteers early in the development of this program, scientists and park managers will be able to evaluate the effectiveness of using citizen scientists, refine monitoring protocols, and build awareness within park communities. Understanding the phenology of various plant and animal species in Acadia NP will ultimately help biologists manage, protect, and preserve the park's natural resources in a changing climate.

Populations of this butterfly (Edith's checkerspot) lay their eggs on specific host plants. As the climate changes, mismatches between when the butterlies lay eggs and when the host plant senescences/matures are becoming more common, driving southern populations of this butterfly to extinction and shifting its range northward. Phenology monitoring is helping us understand the effects of chaning conditions on wildlife species, like Edith's checkerspot, and natural communities (NPS photo).

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Status and Future

Citizen science volunteers participating in the 2009 pilot program will continue to monitor plant and animal phenology in NETN parks through November 2009. Each volunteer monitors three sites in a selected habitat. At each site, a volunteer observes three plant species and three animal species, and makes notes on the weather and site conditions possibly affecting their observations. Volunteers spend about thirty minutes each week observing a variety of tree, shrub, herbaceous plant, reptile, bird, and insect species, including rough-stemmed goldenrod and the monarch butterfly, which are monitored at each participating park.

At the end of the 2009 pilot program, scientists will evaluate data collection techniques, training methods, outreach materials, and the utility of the resulting data for research and management applications. The data collected by volunteers will be compared with expert collected data, where possible, to determine the reliability, quality, and quantity of the observations. Questionnaires will provide information about the volunteers' experiences (e.g., enjoyment, time commitment, problems, materials/training) and the likelihood of volunteer retention.

Data collected by volunteers will inform researchers and park biologists about disruptions in time-sensitive interactions, such as those between plants and pollinators, and their impacts on at-risk species, population dynamics, range limits, and biogeochemical processes.

Beginning in March 2010, the monitoring program will be expanded. The expanded program will include a "self-serve" component at popular, accessible park sites where casual park visitors will be encouraged to monitor easy-to-observe phenological events and then submit data at drop boxes or via email. In addition, more in-depth training sessions will explain to participants how to make relatively advanced, standardized phenological observations (e.g., observations of percent leaf coloring and amphibian egg masses). At these sessions, volunteers will be given maps, data sheets, and other materials for recording observations. The expanded program will provide standardized, systematic phenology monitoring data that can be used to answer questions like, "What environmental cues regulate how a specific species grows and develops?" or "How are milder winters affecting the realationships between speies and their environments?". This information will help all parks to manage, protect, and preserve species and their habitats, enabling visitors to enjoy them for generations to come.

More Information

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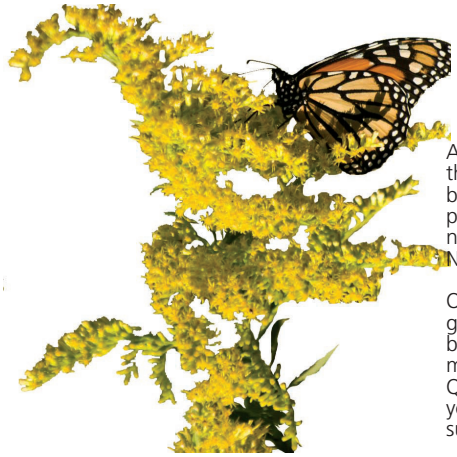
Links & Resources

Northeast Temperate Network: *www.science.nature.nps.gov/im/units/netn/*
USA NPN Website: *www.usanpn.org*



At training sessions, volunteers receive instructions on how to monitor specific species in the park and materials for collecting observations. Volunteers make systematic observations by answering yes or no questions that begin, "Do you see or hear…?" to describe phenophases— the various stages in seasonal biological cycles. Volunteers can also apply their new skills at home and make ontributions to a nationwide dataset maintained by the USA-NPN.

On the Schoodic Peninsula, volunteers observe monarch butterflies, rough-stemmed goldenrod (left, NPS photo), speckled alder (top left, Acadia Partners/S. Delheimer), bumblebees, rugosa rose (top, Acadia Partners/S. Delheimer), late lowbush blueberry, meadowsweet (right, NPS photo), green frogs, Common eiders, and Black guillemots. Questions answered by the 2009 pilot program's Schoodic Peninsula volunteers include, "Do you see > 50% of leaves colored?", Do you see or hear adult frogs?, and "Do you see male summer plumage?".